D R A F T
Risk/Reward -- Topic 1
Regulation Reserves

As part of FERC requirements, transmission operators must provide regulation reserves—capability that keeps the system frequency stable on a real-time basis, while balancing loads and resources plus interchange. When system frequency drops, power is injected into the system from these reserves until any stability problem is resolved—either by changed circumstances or other generation/interchange changes. Similarly, when system frequency gets too high, the machines that provide regulation back off their generation. Adjusting frequency is a continual process, and all of these moves are accomplished through automatic generation control. Regulation reserves support a utility's control area system.

What is needed for regulation reserves in a control area is an amount sufficient to cover the aggregate diversified load. The word diversified is important, because of the potential of offsetting effects. For example, if one set of loads falls and another one increases by an equivalent amount, the effects offset one another and, from those causes, no pressure is put on regulation reserves. In a large system, all loads and resources (plus interchange) will be varying from expectations and schedules in positive or negative directions. The diversity of these loads and resources allows for fewer regulation reserves to be required than would be necessary if all the loads or resources moved in the same direction.

The diversity generally increases as the numbers of customers or generating units increase, because of the long-observed randomness of changes. As a consequence, there is a reduced need for incremental regulation reserves for each increment in the size of the system. These economies of scale provide potential savings when a single provider of regulation reserves can serve a larger load base.

In the Northwest region, regulation is provided almost entirely (?) by hydro resources, either owned or contracted for. In practice, a single generator on a large dam generally is set to increase or decrease output automatically based on automatic signals provided from the transmission owner's control area. In order to provide stability across the system, transmission capacity is reserved (?) for regulation reserves and, therefore, is unavailable for other sales.

While regulation service to increased loads and resources produces capacity savings, there are two caveats: 1) Providing new regulation reserves across congested paths will require decisions regarding reservation of or payment for transmission capacity. If capacity is simply reserved for regulation, the loss in transmission of energy resources needs to be measured as an offset. 2) A transmission capacity reservation for regulation reserves will result in power losses that must be calculated as an offset to the benefits. The greater the distance from the regulation generator, all else equal, the greater will be the power-system losses that must be taken into account.

Issues to Be Considered

The following list summarizes the issues that need to be considered in developing both the societal-economic savings and cost shifts.

- Fuel savings
- MW capacity savings
- Need to reserve and cost of reserving transmission capacity, particularly across constrained paths.
- Power system losses
- Which baseline to compare against
- Allocation of benefits among consolidating parties

Elements in Measuring Societal Economic Benefits

The expected societal economic benefit would come from two sources: 1) A reduction in total quantity of capacity set aside for regional regulation reserves because of the diversity of loads; 2) A reduction in the operating costs of regulation due to the substitution of hydro for thermal generation. Offsetting the societal benefit would be the impacts of transmission constraints and power-system losses.

The quantity of capacity element requires a calculation of the savings that can be expected from a reduction in the number of regulation-reserve providers and the resultant aggregation of loads and resources. By looking at the combined total load to be served, the amount of reserve reduction can be estimated. The amount of these reserves that could be sold would then become the basis for the valuation of this element of the societal economic benefits. In addition, there would be operating-cost savings for entities that no longer have to provide such reserves, but offset by the additional communications equipment required to centralize the flows of information.

The second savings element is the reduction in operating costs of providing regulation energy. To perform this analysis, it is necessary to assess what resources utilities are using today to provide the regulation, to decide, from the previous element, how much will be displaced by a single provider, and finally to estimate the expected production cost savings.

Elements in Measuring Cost Shifts and Other Equity Issues

The problem of cost shifts in combining the regulation-reserve responsibility is minimal. The only caveat to this conclusion regards transmission capacity that is pulled from the market for energy wheeling and is reserved *without charge* for the regulating-reserves transmission, there can be cost shifts. The issue of the costs of such reservations likely would arise in areas that experience transmission constraints, such as those from Idaho or Wyoming into Utah. Measurement of cost shifts, if any, from transmission capacity restrictions needs to await the final market design.

Two major equity issues arise, however, in how the benefits of consolidation are divided: The first is the distribution of the real benefits of reduced capacity needs and fuel savings. There are expected to be savings from these changes in regulation requirements, so the issue is an equitable division of the "pie." The division of this equity issue is of concern to customers of each control area, but likely is a matter of negotiation among the providing and benefiting parties.

Second, there is the impact of Grid West's bidding process. At the margin, the hydro resource owners are likely to bid the alternative cost of providing regulation services, which probably is a thermal unit. Of course, hydro owners could be constrained by market rules that force them to bid the hydro incremental or opportunity costs, whatever the latter may be. Because hydro providers have nearly zero incremental *operating* costs, the gain to them from bidding into a thermal market can be substantial. The increased revenues normally will reduce the rates of the customers of hydro owners, while increasing the regulation-reserve rates of entities that formerly purchase at embedded FERC Schedule 3 rates. [In BPA's case, those rates may actually be higher than "market" Grid West bidding results, which has the opposite result, as utilities drop BPA's service and purchase from Grid West.]

Alternatives and Their Impacts

There are two principal alternate base lines apart from the status quo, which here is assumed to be no action.

The first alternative is a regulation-reserve-sharing agreement similar to the agreement for operating reserves. The status of negotiations is …. This alternative would provide essentially the same benefits as a Grid West solution.

A second alternative is for BPA to revise its tariff rate for regulation reserves to make it more competitive. BPA's current regulation rate is .30 mills per kWh, as compared, for example, to _____ at PGE or _____ PacifiCorp. BPA's current rate is based upon the fixed cost of certain hydroelectric facilities used in providing regulation reserves. A more competitive BPA rate would allow voluntary sharing of regulation reserves without major agreements. This alternative would provide essentially the same benefits as a Grid West solution, while resolving the issue of transmission capacity across certain paths.

Other Issues

It needs to be determined whether or not there are any reliability consequences of providing regulation reserves from the failure of long transmission lines reserved, in part, for providing such reserves.

Summary Data Needs

- Contemporaneous regulation loads for individual control areas to be combined into single control area net load for a few select periods.
- Constrained paths within combined control area.
- Incremental/decremental operating costs of current regulation reserves, including fuel costs.
- Census of resources currently being used for regulation reserves.
- Tentative plan of combined operating reserves.